Indonesia Disaster Watch with Satellite Imagery

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Abstract. The use of remote sensing with satellite images is widely used for disaster management, because it offers extensive information at short intervals. This research provides access to satellite imagery and analysis of satellite imagery that suits your needs. The purpose of this study is to make a simple and elegant application to visualize the location of disasters that occur before, during and after a disaster and can view satellite maps at the disaster site. This application system development method uses the RAD (Rapid Application Development) method with the design of Front-End and Back-End Development systems. This application service produces satellite images namely Landsat-8 with 8 m resolution, Sentinel-2 with 10 m resolution, Sentinel-1 with PEPS API (Sentinel Product Exploitation Platform) whose resolution is also very good. The results of this study are expected to be able to help the community and provide information about the types of disasters, disaster locations and satellite image information in the affected areas

1. Introduction

Indonesia is a country that is vulnerable to disasters. Because there are tectonic and volcanic plates that often experience seismic activity which makes Indonesia vulnerable to earthquakes, landslides and tsunamis and various other types of disasters [1]. The number of disasters in Indonesia has avarietyof reasons, oneof which is Indonesia's geographical location which is located in a ring of fire. According to geospatial data from BNPB or Badan National Penanggulangan Bencana (the Disaster Management Agency)[2], there are 143 active volcanoes in Indonesia which are spread in various parts of Indonesia.

The need for satellite image data in the field of disaster is very important in disaster risk reduction[3]. Satellite image data is used to facilitate decision making in the field in terms of disaster mitigation. Information on spatial data is currently very much needed in providing information quickly with extensive coverage in one region. Availability of disaster location information, types of disasters and satellite imagery can reduce the risk of disasters. Disaster information that is reported directly and quickly can facilitate disaster management and evacuation of victims of disaster areas[4].

From the background above, this research seeks to create a simple platform and visualize the location of the ongoing disaster and provide satellite images at the disaster site[5]. The results of this study are expected to be able to help the community and provide a system of information about disaster locations and provide access to satellite images with the aim of disaster research. With the availability of satellite imagery services that can be carried out in disaster management processes that occur before, occurring and after a disaster in order to reduce the level of risk due to a disaster.

Indonesia Watch Disaster is a natural disaster information system platform in Indonesia. By utilizing the API (Application Programming Interface) satellite image develompment [6]and setting the dataset in the application, it will produce a visualization of Landsat 8, Sentinel-2 and Sentinel-1 satellite images[7][8]. The Indonesia Disaster Watch platform can facilitate access to satellite images with the aim of disaster management[9].

2. Method

This research method uses the Rapid Application Development (RAD) approach, namely Requirement Planing, Design workshop and Implementation[10] . System design method using Front-End and Back-End methods. The RAD method can be seen in Figure 1.

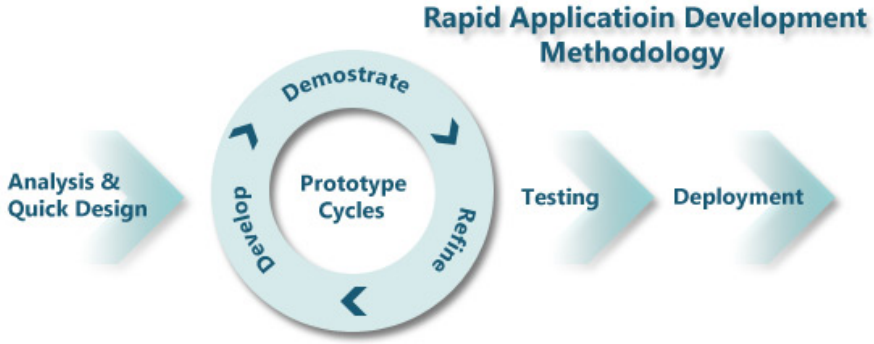

Figure 1. Rapid Application Development Method

Discussing the stages carried out in the RAD discussion, consisting of:

2.1. Requirement Planning

Requirement Planning[10] [11] is an activity to determine the system requirements, namely by identifying information needs, problems encountered, system boundaries and problem solving.
Servers are built using text based Windows operating systems. For the specifications needed are as follows:

a. Hardisk minimum 50 Gb
b. RAM minimum 1 Gb
c. Processor Intel Pentium Dual Core@ 2.0 Ghz
d. Network Interface card 10 Mbit/s

Applications must be installed to support communication and information for the server as in table1.

Table 1. Application will be Installed

Application	Job/Task
Browser	Service display application
ModeJs REST	Provide web and Database service
Monngo DB	Database service

2.2. Design Workshop

Design Workshop [10] [11]is an activity to identify alternative solutions and choose the best solution. Then make a design process and design the programming process with data data that has been obtained and modeled in the information system architecture.

The flowchart diagram below (shown in Figure 2) describes the process of designing the Indonesia Disaster Watch application system. There are 2 methods of designing application systems, namely Front-End and Back-End[11][12]. The Front-End application is an application that functions as an interface between users and systems. Front-End is used to display the latest disaster location data, add

disaster data and visualization of imagery in disaster areas. Users of the Front-End application are all users who access all features in the Front-End application. The Back-End application is data processing that is implemented on a web-based system. Back-End consists of web admin, web service and database server. The user or manager of the Back-End application is part of the resource namely as an admin who has access rights in the action of Create, Read, Update, Delete. In connecting to the database use the NodeJs REST service for imaging provider services. The database server used in this application is the Elastic Search Database or MongoDB. Data on disaster location information and service provider data for images stored in the database server on request are then processed by the web service and then make the data in the form of JavaScript Object Notation (JSON) [12].

The proposed system consists of two sub-systems, namely the Back-End and Front-End. The Back-End section is a web server based application that is intended for system administrators to manage health service facility data and data administrators. The Front-End is an Android-based application intended for users.In visualizing map image images using several APIs namely Planet Lab API, Digital Globe, Landsat API and Sentinel API that produce various image resolutions[12][13].

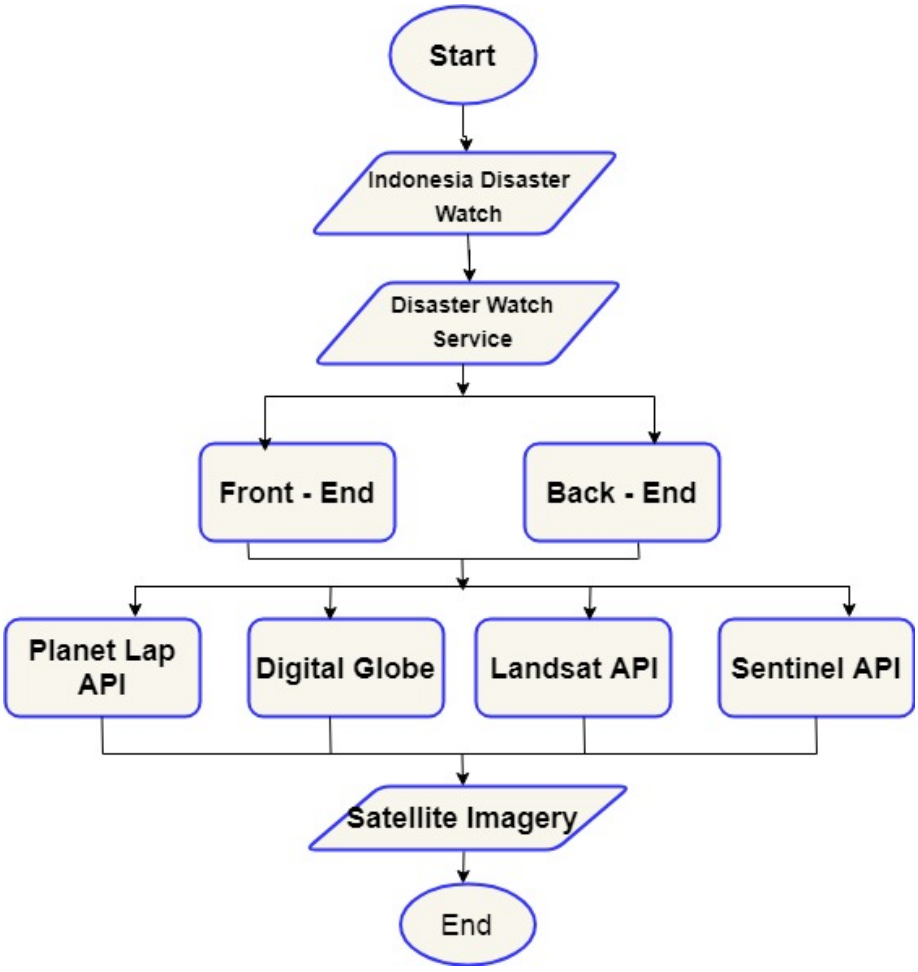

Figure 2. Application system development flowchart

2.3. Implementation

Implementation[10] [11] is the process of making a system by coding into a form that is understood by a machine that is realized in the form of a program or unit program. The purpose of the implementation stage is to construct the system and the application of methods in programming the

results of system requirements and will be explained in the stages of database implementation in the form of directories of structures and directories of API Development structures.

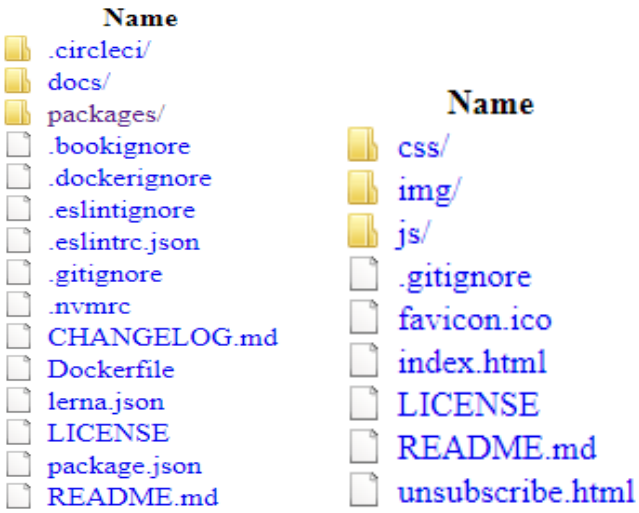

Figure 3. Data set API Development and Directory Structure Application

3. Result and Disscusion

The results of the implementation process based on Rapid Application Development method with the design of Front-End and Back-End are in accordance with the results of the analysis and modeling performed. The following are the results of the design implementation of each web page that has been created.

3.1. Front-End

The Front-End application [11][12]requests data on disaster information, disaster locations and satellite image data in the database. The main features of the Front End application are add disaster, disaster location and visualization of sattelite imagery. The flowchart diagram is shown in Figure 4.

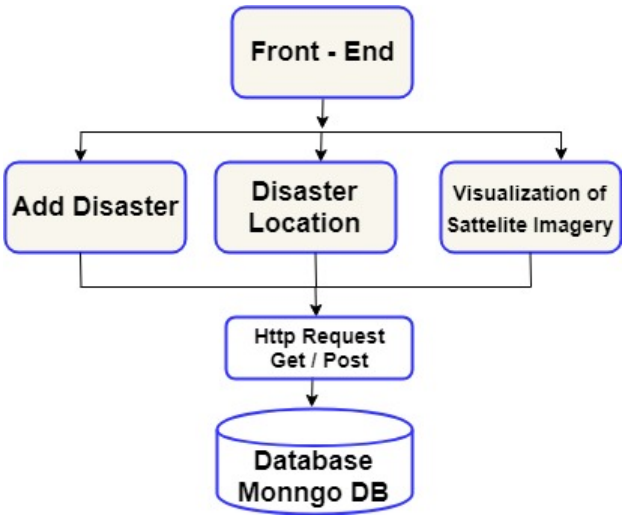

Figure 4. Designing a system with Front-End

3.1.1 Add Disaster

Front-End application features added disaster is a form to add disaster data, disaster type, location, disaster time, email and commnet. Display of disaster-added menus is shown in Figure 5.

Figure 5. Display form added disaster

3.1.2 Location of the Disaster

Front-End application for disaster location is a feature to find out the location of a disaster that has entered disaster data by the user. Display of disaster locations menus is shown in Figure 6.

Figure 6. Display Locations Disaster

3.1.3 Citra Visualization

Front-End application of image visualization is a feature that can display disaster information in Indonesia. Image visualization in the form of Landsat-8, Sentinel-2 and Sentinel-1 images is supported by the PEPS Satellite Development API[13]. The visualization display image is shown in Figure 7

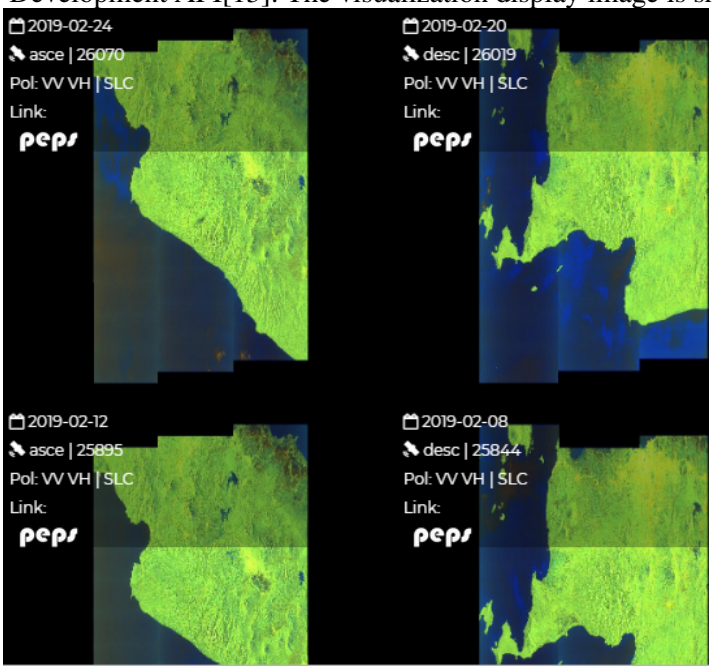

Figure 8. Citra visualization

3.2. Back-End

The Back-End application [11][12]stores data on disaster information, disaster locations and satellite image data in the database. Web service as a system facility used to provide services in the form of information to other systems, so that other systems can interact with this system through services provided by a system that provides Back-End Indonesia Disaster Watch application web services. The web service used uses Hypertext Preprocessor (PHP) and JavaScript Object Notation (JSON). PHP which provides a web service service that will process requests then generates JSON as a result of processing requests. The generated JSON data provided for requesting by the Front-End application Flowchart diagram can be seen in Figure 9.

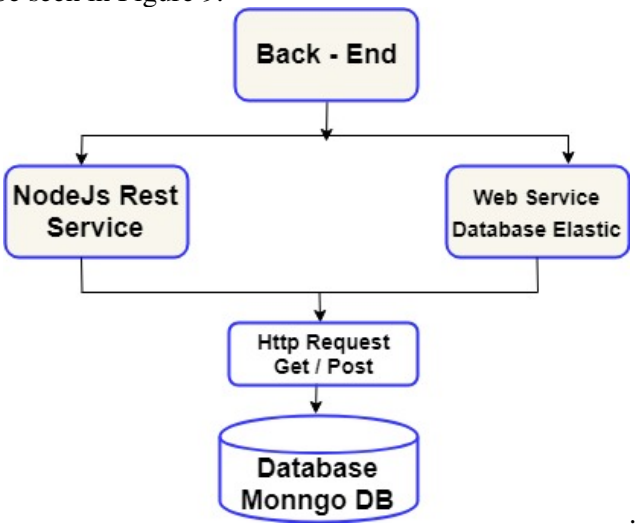

Figure 9. Designing a system with Back –End

3.2.1 Database of Disaster

Disaster databases contain information about the types of disasters, disaster locations, disaster times, Landsat 8 images, sentine-2 images, and sentine-1 images. Disaster Database Information is shown in Figure 10.

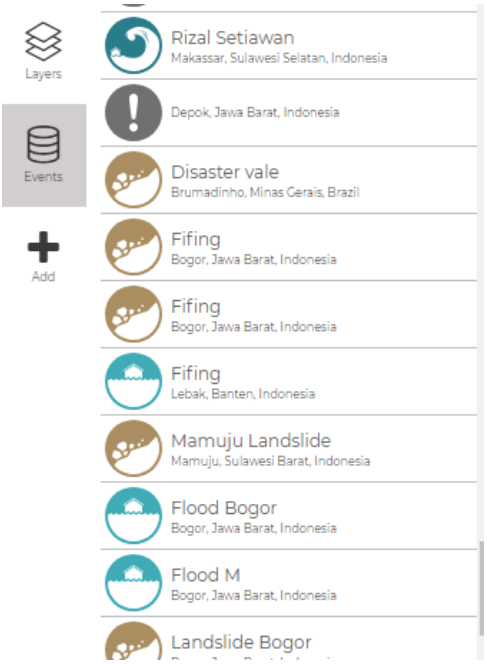

Figure 10. Database Disaster

3.3 Display of Satellite Imagery

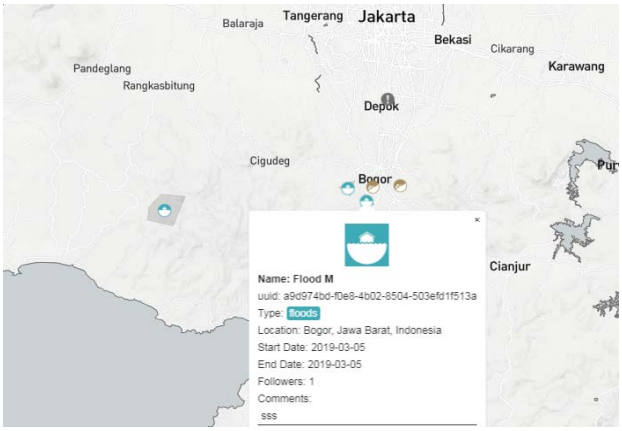

Figure 11. Basemaps Mapbox

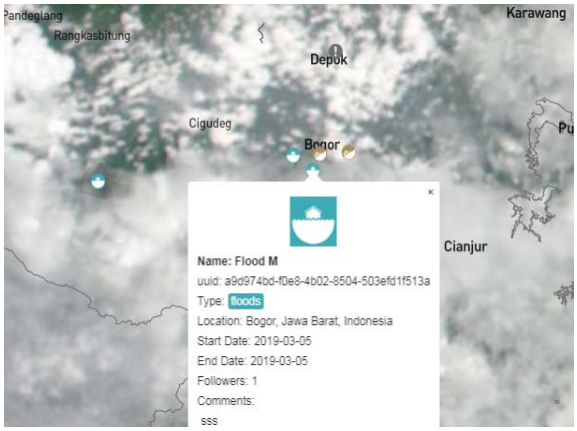

Figure 12. Basemaps Aqua True Color

The Basemap view on the Indonesia Disaster Watch application is Basemaps Mapbox show in Figure 11. and Basemaps Aqua True Color show in Figure 12. Both of these basemap displays are generated from the PEPS Satellite Development API dataset. The Indonesia Disaster Watch application can provide Lansat 8, Sentinel 2 and Sentinel 1 satellite images in the disaster area.

4. Conclusion

This study was designed to build information system that helps communication and information about the locationof the disaster. The disaster information system application was built using a PC with programming languages and API Development services. Indonesia Disaster Watch provides information about disasters, types of disasters, location, time and availability of satellite images in

disaster areas. Information on disasters can be carried out by Indonesia. Disaster Watch can send information in real time. With fast and accurate information about the budget in Indonesia, decision making can be done properly. So, it can reduce the level of risk due to disasters.

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